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(72) Inventors:  
• Yano, Tetsuya, Fujitsu Limited  
Kawasaki-shi, Kanagawa 211-8588 (JP)  
• Obuchi, Kazuhisa, Fujitsu Limited  
Kawasaki-shi, Kanagawa 211-8588 (JP)  
• Kawabata, Kazuo, Fujitsu Limited  
Kawasaki-shi, Kanagawa 211-8588 (JP)

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(71) Applicant: FUJITSU LIMITED  
Kawasaki-shi, Kanagawa 211-8588 (JP)

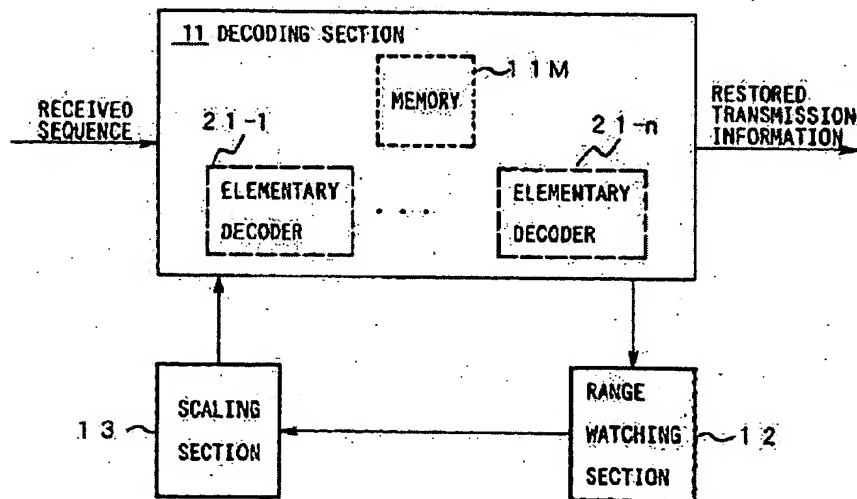
(74) Representative: HOFFMANN - EITLE  
Patent- und Rechtsanwälte  
Arabellastrasse 4  
81925 München (DE)

(54) Turbo decoder

(57) A turbo decoder is provided in which a distribution of likelihood values that are obtained during the course of turbo-decoding is watched and scaling of an operation object to be subjected to subsequent likelihood

hood computation of the turbo-decoding is performed in accordance with the distribution. This turbo decoder can reduce the cost, size, and power consumption of a transmission system and equipment, increase their reliability, and improve the transmission quality and performance.

FIG. 1





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## EUROPEAN SEARCH REPORT

Application Number  
EP 00 11 0944

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| The present search report has been drawn up for all claims |  |  |  |
| Place of search:<br><b>MUNICH</b>                          |  | Date of completion of the search:<br><b>21. August 2003</b>  | Examiner:<br><b>Burkert, F</b>               |
| CATEGORY OF CITED DOCUMENTS                                |  | T: theory or principle underlying the invention<br>E: earlier patent document, but published on, or after the filing date<br>D: document cited in the application<br>L: documents cited for other reasons<br>A: member of the same patent family, corresponding document<br>X: particularly relevant if taken alone<br>Y: particularly relevant if combined with another document of the same category<br>A: technological background<br>O: non-written disclosure<br>P: intermediate document |  |

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Application Number  
EP 00 11 0944

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| Place of search<br>MUNICH  |  | Date of completion of the search<br>21 August 2003  | Examiner<br>Burkert, F                      |
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EPO FORM 1503 01/87 (Rev. 01/11)



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Application Number  
EP 00 11 0944

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| Place of search<br><b>MUNICH</b>  |  | Date of completion of the search<br><b>21 August 2003</b> | Examiner<br><b>Burkert, F</b>                |
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EP 00 11 0944 (PCT/01)



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| The present search report has been drawn up for all claims.  |  |   |  |
| Place of search<br><b>MUNICH</b>   |  | Date of completion of the search<br><b>21 August 2003</b> | Examiner<br><b>Burkert, F</b>                |
| <p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>A : member of the same patent family, corresponding document</p> |  |   |  |

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Application Number

EP 00 11 0944

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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LACK OF UNITY OF INVENTION  
SHEET B

Application Number  
EP 00 11 0944

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions; namely:

1. Claims: 1, 2, 3, 5, 6, 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, 23, 24, 26, 27, 29, 30, 32, 33, 35, 36, 38, 39, 41, 42, 44, 45, 47, 48, 50, 51, 53, 54

A turbo decoder with scaling of the extrinsic information, in which the soft channel values (LLRs) representing the systematic bit ("non-coded word") are scaled by a scaling factor, which is determined by a scaling means in dependence on a distribution of likelihood values obtained during the course of turbo decoding.

2. Claims: 4, 13, 22, 31, 40, 49

A turbo decoder with scaling of the extrinsic information, which comprises  $n$  elementary decoders with  $n$  being smaller than the dimension of the parallel concatenated turbo code (where the dimension denotes the number of component codes).

3. Claims: 10, 28, 46

A turbo decoder with scaling of the extrinsic information, which comprises memory to be used for interleaving and deinterleaving, where the scaling of the extrinsic information is performed while reading from said memory.

4. Claim : 19

A turbo decoder with scaling of the extrinsic information, in which the scaling factor reduces the width of the range of likelihood values below a prescribed threshold, if the width of the range has exceeded this threshold.

5. Claim : 37

A turbo decoder with scaling of the extrinsic information, in which a range watching means obtains a distribution of likelihood values as a maximum value or as an average of likelihood values obtained in previous steps.

6. Claims: 7, 16, 25, 34, 43, 52

A turbo decoder with scaling of the extrinsic information, which comprises a single elementary decoder that decodes all component codes of the turbo code in series, where the component codes may be different

# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 00 11 0944

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EPO FORM P455

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82



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